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The Changing Nature of Faculty Employment

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The Changing Nature of Faculty Employment

Abstract

[Excerpt] The last two decades of the twentieth century saw a significant growth in the shares of faculty members in American colleges and universities that are part-time or are full-time without tenure-track status (Anderson 2002, Baldwin and Chronister 2001, Conley et al. 2002). Growing student enrollments faced by academic institutions during tight financial times, and growing differentials between the salaries of part-time and full-time non-tenure-track faculty on the one hand, and tenured and tenure-track faculty on the other hand, are among the explanations given for these trends. However, surprisingly, there have been few econometric studies that seek to test whether these hypotheses are true.

Our chapter begins by presenting information, broken down by form of control (public/private) and 1994 Carnegie category, on how the proportions of full-time faculty at four-year American colleges and universities that are tenured, on tenure tracks and are not on tenure tracks have changed since 1989, using information for a consistent sample of institutions from the annual IPEDS Faculty Salary Surveys and the biennial IPEDS Fall Staff Surveys. The latter source also permits us to present similar estimates of the proportions of faculty that are employed part-time and the share of new full-time faculty appointments that are not on tenure tracks.

Keywords

higher education, faculty, employment, academic labor market, tenure, non-tenured

Disciplines

Education Economics | Higher Education | Labor Economics | Labor Relations

Comments

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3. The changing nature of faculty employment

Ronald G. Ehrenberg and Liang Zhang

3.1 INTRODUCTION

The last two decades of the twentieth century saw a significant growth in the shares of faculty members in American colleges and universities that are part-time or are full-time without tenure-track status (Anderson 2002, Baldwin and Chronister 2001, Conley et al. 2002). Growing student enrollments faced by academic institutions during tight financial times, and growing differentials between the salaries of part-time and full-time non-tenure-track faculty on the one hand, and tenured and tenure-track faculty on the other hand, are among the explanations given for these trends. However, surprisingly, there have been few econometric studies that seek to test whether these hypotheses are true.¹

Our chapter begins by presenting information, broken down by form of control (public/private) and 1994 Carnegie category, on how the proportions of full-time faculty at four-year American colleges and universities that are tenured, on tenure tracks and are not on tenure tracks have changed since 1989, using information for a consistent sample of institutions from the annual IPEDS Faculty Salary Surveys and the biennial IPEDS Fall Staff Surveys.² The latter source also permits us to present similar estimates of the proportions of faculty that are employed part-time and the share of new full-time faculty appointments that are not on tenure tracks.

To analyse the role that economic variables play in causing changes in faculty employment across categories, we conduct two types of econometric analyses. First, in section 3.3, we use panel data to estimate demand functions for tenure and tenure-track faculty on the one hand, and full-time non-tenure-track faculty on the other hand, to learn how changes in revenues per student and the average salaries of different types of full-time faculty influence the distribution of faculty across categories of full-time faculty. We do this using both models that assume instantaneous adjustments of employment of different types of faculty to changes in revenues

and salaries of different types of faculty and models that permit adjustments of faculty employment to these changes to take place over a number of periods.

Second, in section 3.4, we estimate models that seek to explain the flow of new hires of each type of faculty member (rather than the levels of faculty employment) using data on new hires that are available from the IPEDS Fall Staff Surveys. To explain new hires, in addition to information on changes in revenues per student, changes in enrollment and the levels of faculty salaries, we require information on the number of vacant faculty positions that are potentially available to be filled. We construct information on the latter using data on the number of continuing full-time faculty members at an institution each year that the American Association of University Professors (AAUP) collects (but does not publish) as part of its annual salary survey.

Continuing faculty members in a rank are defined as the number of faculty members in a rank one year, who also are on the payroll of the institution in the next year, regardless of their rank in the second year. Summing up an institution's continuing faculty members across ranks in a year and subtracting that number from the institution's total faculty employment in the previous year provides us with an estimate of the number of full-time faculty vacancies that an institution could have filled in a year if it had replaced each of its departing full-time faculty members.

A brief concluding section summarizes our findings and discusses their implications for American colleges and universities and their students.

3.2 CHANGES IN FACULTY COMPOSITION

Table 3.1 provides annual data on the share of full-time faculty members that are not employed in tenured or tenure-track positions at four-year colleges and universities in the United States for the 1989 to 1999 period. The data come from the annual IPEDS Faculty Salary Surveys and are tabulated separately by form of control and 1994 Carnegie category. Because a few institutions fail to report survey data each year, we restrict our attention to a sample of 504 public and 854 private colleges and universities that responded to the survey each year.

In the aggregate, the ratio of full-time non-tenure-track faculty to total full-time faculty rose from 0.110 to 0.137 at the public institutions in the sample, and from 0.142 to 0.197 at the private institutions in the sample. Contrary to what one might have expected, given the well-known budget problems of public higher education during the period, the increased usage

Table 3.1 Ratio of full-time non-tenure-track faculty/total full-time faculty

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999*
Public (sample size)											
Research I (59)	0.099	0.100	0.099	0.099	0.097	0.101	0.099	0.102	0.112	0.121	0.128
Research II (26)	0.109	0.105	0.100	0.095	0.094	0.096	0.096	0.102	0.112	0.120	0.123
Doctoral I (28)	0.117	0.117	0.114	0.110	0.116	0.119	0.121	0.124	0.128	0.149	0.160
Doctoral II (38)	0.121	0.126	0.129	0.125	0.121	0.128	0.121	0.132	0.133	0.139	0.149
Comprehensive I (246)	0.111	0.117	0.108	0.111	0.107	0.109	0.111	0.114	0.124	0.128	0.138
Comprehensive II (25)	0.148	0.138	0.129	0.153	0.133	0.129	0.129	0.127	0.135	0.131	0.160
Liberal arts I (7)	0.213	0.220	0.203	0.180	0.157	0.116	0.120	0.125	0.103	0.092	0.103
Liberal arts II (75)	0.134	0.131	0.134	0.140	0.147	0.138	0.139	0.135	0.141	0.153	0.165
Total	0.110	0.112	0.108	0.108	0.107	0.109	0.109	0.112	0.121	0.128	0.137
Private (sample size)											
Research I (29)	0.124	0.173	0.148	0.171	0.167	0.159	0.166	0.172	0.151	0.156	0.154
Research II (11)	0.065	0.083	0.078	0.089	0.095	0.108	0.113	0.118	0.121	0.128	0.127
Doctoral I (23)	0.092	0.105	0.107	0.102	0.088	0.161	0.141	0.154	0.163	0.180	0.194
Doctoral II (22)	0.123	0.096	0.107	0.102	0.141	0.123	0.090	0.107	0.115	0.132	0.141
Comprehensive I (180)	0.146	0.171	0.165	0.182	0.190	0.181	0.189	0.193	0.203	0.193	0.221
Comprehensive II (65)	0.186	0.258	0.253	0.265	0.260	0.215	0.223	0.223	0.225	0.233	0.226
Liberal arts I (156)	0.109	0.102	0.095	0.097	0.098	0.099	0.102	0.109	0.115	0.119	0.130
Liberal arts II (368)	0.226	0.244	0.250	0.259	0.275	0.284	0.275	0.277	0.288	0.295	0.306
Total	0.142	0.165	0.158	0.169	0.175	0.176	0.176	0.182	0.184	0.187	0.197

Note: *The estimates for 1999 are based on preliminary data released by NCES (2004)

Source: National Center for Educational Statistics (NCES) IPEDS Faculty Salary Survey

of full-time non-tenure-track faculty was larger at the private than at the public institutions. Moreover, for almost all Carnegie categories, the share of full-time faculty that is not on tenure tracks was higher in 1999 at private institutions than it was at public institutions.³

Appendix A provides similar tabulations for the 1989 to 2001 period using data from the biennial IPEDS Fall Staff Surveys.⁴ There are a number of important differences in the definition of faculty in the two surveys. The Staff Survey includes faculty on visiting appointments, while the Faculty Salary Survey does not. Inasmuch as visitors are non-tenure-track appointments (from the perspective of the reporting institution) this will cause the shares of non-tenure-track employees to be higher in the Staff Survey. The Faculty Salary Survey is restricted to instructional faculty, while the Fall Staff Survey also includes faculty without any instructional responsibilities who are entirely on research or public service appointments. This also probably leads the share of full-time faculty that is on non-tenure-track appointments to be higher in the Staff Survey data.

The tabulations in Appendix Table A.1 are for a sample of 319 public and 761 private four-year colleges and universities that participated in the Staff Survey each year. While the share of full-time faculty on non-tenure tracks is also higher at private institutions than at public institutions in this sample, the increase was greater during the period at the publics than at the privates, due primarily to large increases at the public Research I and Research II institutions. This suggests that a growing usage of full-time non-tenure-track faculty positions for full-time researchers may be responsible for the increases at these institutions.

In Table 3.2, we provide some evidence on the growing usage of part-time faculty members. Part-time faculty data are available in the Fall Staff Survey but not in the Faculty Salary Survey. The numbers presented in the table represent the ratio of total part-time faculty members to total full-time faculty members at a set of institutions that were both in the sample each year and reported positive numbers of part-time faculty members in each year.⁵ The ratios are calculated using a sample of 352 public and 483 private institutions.

During the 1989 to 2001 period, the ratio of part-time to full-time faculty members rose from 0.269 to 0.377 at the public institutions in the sample and from 0.499 to 0.686 at the private institutions in the sample. In 2001, the share of part-time faculty was higher for each Carnegie category of institution at private institutions than it was at public institutions.

Finally, the Fall Staff Survey also contains information on whether faculty members who are newly hired during the academic year are on tenured, tenure-track or non-tenure-track appointments. Remembering

Table 3.2 Ratio of part-time faculty/total full-time faculty

	1989	1991	1993	1995	1997	1999 ^a	2001 ^a
Public (sample size)							
Research I (50)	0.211	0.195	0.229	0.222	0.285	0.268	0.260
Research II (22)	0.153	0.214	0.175	0.197	0.201	0.224	0.219
Doctoral I (23)	0.304	0.316	0.364	0.358	0.348	0.394	0.352
Doctoral II (34)	0.335	0.234	0.329	0.380	0.407	0.455	0.503
Comprehensive I (174)	0.350	0.352	0.397	0.415	0.454	0.478	0.541
Comprehensive II (10)	0.372	0.387	0.383	0.373	0.456	0.557	0.484
Liberal arts I (2) ^b	—	—	—	—	—	—	—
Liberal arts II (37)	0.484	0.558	0.611	0.658	0.674	0.667	0.631
Total	0.269	0.263	0.298	0.306	0.347	0.365	0.377
Private (sample size)							
Research I (22)	0.215	0.300	0.387	0.440	0.494	0.329	0.416
Research II (8)	0.430	0.351	0.410	0.418	0.406	0.464	0.420
Doctoral I (12)	0.792	0.631	0.694	0.702	1.043	1.127	0.923
Doctoral II (13)	0.551	0.634	0.633	0.780	0.816	0.643	0.643
Comprehensive I (109)	0.909	0.882	0.945	1.032	1.016	1.045	1.186
Comprehensive II (36)	0.708	0.745	1.083	1.116	1.239	0.903	0.949
Liberal arts I (111)	0.309	0.330	0.367	0.349	0.391	0.320	0.358
Liberal arts II (172)	0.685	0.766	0.852	0.887	0.947	0.788	0.885
Total	0.499	0.532	0.599	0.643	0.697	0.622	0.686

Notes:^aThe numbers for 1999 and 2001 are from preliminary data released by the NCES^bProportions not reported because of the small sample size*Source:* National Center for Educational Statistics, IPEDs Fall Staff Survey (2004)

that these data include visiting faculty members and faculty members on research or public service appointments who do not have any instructional responsibilities, Table 3.3 presents information for the 1989 to 2001 period on the shares of new faculty appointments that are neither tenured nor on tenure-tracks. These tabulations are for a set of 383 public and 516 private institutions that reported data on new faculty hires each year.

Overall, the share of new full-time faculty appointments not on tenure tracks increased from 0.460 to 0.515 at public institutions and from 0.452 to 0.573 at private institutions in the sample during the period. Increasingly, new faculty members at four-year colleges and universities in the United States are being appointed to positions that are not on tenure tracks.⁶

Table 3.3 Ratio of non-tenured new hires/total new hires

	1989	1991	1993	1995	1997	1999*	2001*
Public (sample size)							
Research I (53)	0.543	0.546	0.575	0.558	0.622	0.684	0.573
Research II (25)	0.411	0.372	0.501	0.475	0.545	0.524	0.523
Doctoral I (22)	0.481	0.565	0.495	0.461	0.495	0.564	0.514
Doctoral II (31)	0.377	0.418	0.509	0.516	0.536	0.505	0.502
Comprehensive I (191)	0.395	0.382	0.410	0.410	0.429	0.435	0.429
Comprehensive II (17)	0.410	0.357	0.385	0.314	0.415	0.488	0.532
Liberal arts I (3)	0.449	0.577	0.559	0.382	0.531	0.339	0.451
Liberal arts II (41)	0.404	0.398	0.393	0.450	0.411	0.435	0.566
Total	0.460	0.460	0.494	0.485	0.529	0.565	0.515
Private (sample size)							
Research I (25)	0.636	0.594	0.630	0.602	0.708	0.656	0.700
Research II (10)	0.409	0.511	0.536	0.459	0.460	0.457	0.423
Doctoral I (16)	0.528	0.466	0.562	0.568	0.528	0.413	0.641
Doctoral II (13)	0.328	0.324	0.456	0.588	0.416	0.452	0.499
Comprehensive I (117)	0.351	0.476	0.416	0.507	0.418	0.526	0.461
Comprehensive II (39)	0.310	0.351	0.477	0.451	0.359	0.441	0.443
Liberal arts I (119)	0.427	0.447	0.494	0.508	0.556	0.563	0.583
Liberal arts II (177)	0.281	0.302	0.386	0.360	0.405	0.448	0.547
Total	0.452	0.473	0.503	0.518	0.526	0.542	0.573

Note: *The numbers for 1999 and 2001 are from preliminary data released by NCES

Source: National Center for Education Statistics, IPEDs Fall Staff Survey (2004)

3.3 THE DEMAND FOR TENURE-TRACK AND NON-TENURE-TRACK FACULTY MEMBERS

Consider an academic institution which, for simplicity, hires only two types of faculty members – tenure and tenure-track (F_T) and non-tenure-track (F_N). The latter category includes both full-time and part-time faculty members. The academic institution is assumed to derive benefits from hiring more of each type of faculty member relative to the number of full-time equivalent students that are enrolled at the institution (E). Mathematically, this is expressed by saying that it derives utility from its employment of each category relative to its number of full-time equivalent enrolled students.

$$U(F_T/E, F_N/E) \quad (3.1)$$

Tenured and tenure-track faculty members are important to the academic institution because, in addition to teaching, they: advise students about their courses of study and provide advice and letters of recommendation for postgraduate education and employment opportunities; conduct research; share governance responsibilities with the administration and the trustees; and provide long-term stability to the institution. Full-time non-tenure-track faculty may be important to the institution because, in the absence of the responsibility to produce research, they can be assigned higher teaching loads and can specialize in teaching. Part-time non-tenure-track faculty are valuable because, in areas in which there is a large supply of people willing to work in such positions, they provide the institution with an inventory of instructors who can be hired at the last moment to meet fluctuations in demand. In fields that deal directly with 'real world' matters, such as engineering and business, full-time employed professionals willing to teach part-time also provide a type of specialized instruction that institutions might otherwise not be able to offer. In a world in which revenue sources are increasingly uncertain, both types of non-tenure-track faculty members provide the academic institution with flexibility in meeting rapid changes in its financial situation that the tenure system would otherwise constrain it from doing.

Suppose that the average salary per full-time tenured and tenure-track faculty member to the institution is S_T and the average salary per non-tenure-track faculty member is S_N . If the funds, per full-time equivalent student, that the institution has available to employ faculty are B/E and the institution seeks to maximize its utility from hiring faculty members subject to the constraint that the employment budget is exhausted, then the employment demand curves (3.2) and (3.3) will result.

$$F_T/E = F_T/E(S_T, S_N, B/E) \quad (3.2)$$

$$F_N/E = F_N/E(S_T, S_N, B/E) \quad (3.3)$$

The employment of each type of faculty per full-time equivalent student will depend upon the salaries for both types of faculty members and the funds that are available to employ faculty members. Other factors held constant, when a faculty type's average salary level rises an institution will hire fewer of that type of faculty member and, if its demand for that type of faculty members is elastic with respect to the faculty type's average salary, substitute more faculty members of the other type.⁷ An increase in the per full-time equivalent student faculty employment budget will usually lead to an increase in both types of faculty members per full-time equivalent student. This is likely to be true for institutions that do not

have a strong research component in their faculty members' portfolio of responsibilities. However institutions that value research highly might employ fewer non-tenure-track faculty members as their faculty employment budget expands.

In this section, we employ nine years of institutional level data that span the fall 1989 to fall 1997 period to estimate variants of equations (3.2) and (3.3) for a national sample of four-year colleges and universities. Because no information is available to us on the salaries paid to part-time faculty members, we confine our attention only to the employment of full-time faculty members. Initially, we treat all professorial level faculty (professors, associate professors and assistant professors) as tenured and tenure-track faculty, all lecturers as non-tenure-track faculty and exclude instructors from the analyses.⁸ These assumptions allow us to easily compute average faculty salary variables for tenured and tenure-track and for non-tenure-track faculty members at each institution. However, nationally a small percentage of professorial faculty are actually not on tenure-track lines and a small percentage of lecturers are tenured or on tenure-track lines. Hence, we relax these assumptions below and also include instructors in the analyses.

Table 3.4 provides estimates of four different specifications of models based upon equations (3.2) and (3.3). All are estimated in logarithmic form and include institutional level dichotomous (0,1) variables to control for differences in the nature of the curriculum, the research intensity of the institution and other omitted forces that might influence the usage of different types of faculty members. Inasmuch as the funds available to employ faculty depends upon the revenues coming into the institution, in each equation we replace the per full-time equivalent student faculty employment budget of an institution by its revenues per full-time equivalent student that are available to hire faculty members.⁹

Panel A provides baseline estimates. The elasticities of both professorial faculty and lecturers with respect to revenue per student are both close to unity – a given percentage change in revenue per student leads to approximately the same percentage changes in employment of both types of faculty. Professorial faculty members' employment is very sensitive to their own salaries – a given percentage change in professorial faculty members' average salaries is associated with approximately an equal but opposite percentage change in their employment level – but is insensitive to the salary levels of lecturers. In contrast, lecturers' employment levels are not very sensitive to their own salary levels – a given percentage change in lecturers' salaries leads to a much smaller percentage change in the opposite direction in their employment level – and is negatively related to the salary levels of professorial faculty. As we shall show, the latter result does not

continue to hold in models that allow for gradual adjustment of faculty employment levels to faculty salary levels.

Panel B presents similar estimates for equations that also include dichotomous (0,1) variables for each year. The latter are included to control for omitted variables that may vary systematically over time and influence the demand for faculty members. For example, in years in which students' financial need is high, colleges and universities may have to use more funds for institutional grant aid and thus have fewer resources available to employ faculty members. While the inclusion of the year dichotomous variables marginally reduces the magnitudes (in absolute value) of the responsiveness of faculty employment levels to faculty salaries, in the main the results are similar to those in panel A.

The estimates in panels A and B assume that faculty employment levels adjust instantaneously to changes in faculty salaries. However, there may be lags in the adjustment process due to the presence of tenured faculty members and tenure-track and non-tenure-track faculty members who are on multiyear contracts. To allow for only partial adjustment of faculty employment levels to changes in faculty salaries and revenue in a year, panels C and D present estimates of models that include lagged (one year) values of the logarithm of the faculty category's employment level as an additional explanatory variable.¹⁰ These models are estimated using dynamic estimation methods that control for the endogeneity of the lagged dependent variables (see Arellano and Bond, 1991).

The coefficient of the lagged dependent variable in the professorial employment equation is very close to zero, which implies that an almost immediate adjustment of tenure and tenure-track faculty employment levels to changes in their salary levels occurs. This implies that normal voluntary turnover creates sufficient vacancies each year that adjustment to new desired employment levels can rapidly occur, even when desired employment levels are falling. In contrast, there is evidence of somewhat slower adjustment in the demand for non-tenure-track faculty members.¹¹ Moreover, once we allow for only partial adjustment to changing salaries and revenue to occur, the demand for both tenure and tenure-track faculty members on the one hand, and non-tenure-track faculty members on the other hand, become relatively insensitive to changes in their own salaries – a given percentage increase in the salary of each group leads to a smaller per cent change in the opposite direction of employment of the group. In addition, higher salaries for tenured and tenure-track faculty are now seen to lead to an increase in the employment of non-tenure-track faculty.¹²

The estimated coefficients in Table 3.4 come from models in which all professorial faculty are assumed to be tenure or tenure-track and all

Table 3.4 Logarithmic faculty demand functions estimates: instructors excluded (t statistics in parentheses)*

	Log (all professorial faculty per student)	Log (lecturers per student)
(A) Without year effects		
Log (ave. all prof. faculty salary)	-1.0667 (-27.27)	-0.7244 (-5.65)
Log (ave. lecturer salary)	0.0154 (0.64)	-0.1933 (-2.48)
Log (revenue per student)	0.8216 (58.55)	0.8375 (18.23)
R ²	0.9428	0.9109
N	2019	2019
(B) With year effects		
Log (ave. all prof. faculty salary)	-0.9645 (-22.89)	-0.5435 (-3.88)
Log (ave. lecturer salary)	0.0157 (0.67)	-0.1853 (-2.38)
Log (revenue per student)	0.8409 (59.6)	0.8586 (18.32)
R ²	0.9449	0.9117
N	2019	2019
(C) Without year effects		
Lagged dependent variable	0.0430 (2.23)	0.1461 (4.07)
Log (ave. all prof. faculty salary)	-0.2291 (-3.08)	0.6330 (1.99)
Log (ave. lecturer salary)	-0.0041 (-0.20)	-0.1911 (-2.21)
Log (revenue per student)	0.6659 (21.09)	0.5510 (4.09)
Wald chi squared	459	43
N	1326	1291
(D) With year effects		
Lagged dependent variable	0.0079 (0.46)	0.1527 (4.31)
Log (ave. all prof. faculty salary)	-0.2986 (-4.08)	0.6437 (2.00)
Log (ave. lecturer salary)	-0.0011 (-0.06)	-0.1856 (-2.15)
Log (revenue per student)	0.6561 (21.27)	0.5670 (4.19)
Wald chi squared	480	51
N	1326	1291

Note: * All professorial faculty are considered tenured, and tenure-track faculty and all lecturers are considered non-tenure-track faculty. Instructors are excluded from the analyses

lecturers are assumed to be non-tenure-track. In actuality there is a small percentage of non-tenure-track faculty members in the professorial groups, a small percentage of tenured and tenure-track faculty members in the lecturer group and instructors, excluded from the analyses in Table 3.4, are in both groups. It is straightforward for us to accurately compute the employment of tenured and tenure-track faculty members at each institution and the employment of non-tenure-track faculty members at each institution

from the Faculty Salary Survey data. However, additional assumptions must be made to enable us to obtain estimates of the average salaries of the two different types of faculty at each institution. Specifically, we assume that the average salary of non-tenure-track faculty at each rank at an institution is a multiple of the average salary of tenure and tenure-track faculty at the rank at the institution. This multiple is allowed to vary across institutions and over time but is assumed to be constant across ranks at an institution at a point in time.¹³

Making this assumption, Table 3.5 presents estimate similar to those found in Table 3.4 for the more accurately defined measures of tenured

Table 3.5 Logarithmic faculty demand functions: tenure-track status correctly assigned (t statistics in parentheses)

	Log (tenure & tenure-track per student)	Log (non-tenured per student)
(A) Without year effects		
Log (ave. ten. and ten.-track fac. sal.)	-0.1791 (-5.26)	0.9869 (11.12)
Log (ave. non-ten.-track fac. sal.)	0.0198 (0.75)	-1.0508 (-15.24)
Log (revenue per student)	0.2482 (17.48)	0.3157 (8.52)
R ²	0.9166	0.8012
N	7654	7654
(B) With year effects		
Log (ave. ten. and ten.-track fac. sal.)	-0.0748 (-2.1)	1.1071 (11.86)
Log (ave. non-ten.-track fac. sal.)	0.0222 (0.85)	-1.0438 (-15.17)
Log (revenue per student)	0.2921 (19.63)	0.3620 (9.28)
R ²	0.9179	0.8024
N	7654	7654
(C) Without year effects		
Lagged dependent variable	0.0809 (2.00)	0.3314 (12.57)
Log (ave. ten. and ten.-track fac. sal.)	-0.0797 (-1.48)	2.0236 (11.21)
Log (ave. non-ten.-track fac. sal.)	-0.0416 (-1.53)	-0.8309 (-8.92)
Log (revenue per student)	0.3831 (14.89)	0.3157 (3.76)
Wald chi squared	227	311
N	5224	5061
(D) With year effects		
Lagged dependent variable	0.1280 (3.27)	0.3317 (12.82)
Log (ave. ten. and ten.-track fac. sal.)	-0.0979 (-1.79)	2.0331 (11.27)
Log (ave. non-ten.-track fac. sal.)	-0.0415 (-1.50)	-0.8373 (-9.01)
Log (revenue per student)	0.3920 (14.99)	0.3299 (3.92)
Wald chi squared	248	347
N	5224	5061

and tenure-track and non-tenure-track faculty. The estimated percentage changes that occur in both types of faculty employment in response to any given change in revenue per student are much smaller in panels A and B, than the comparable estimates in Table 3.4. The demand for tenured and tenure-track faculty is now relatively unresponsive to changes in the group's average salary – every one percentage point change in the group's average salary leads to a smaller change in the opposite direction in employment of the group – while percentage changes in non-tenure-track faculty members' average salary now lead to equal but opposite changes in their employment levels. Increases in tenure-track faculty salaries, holding constant non-tenure-track faculty salaries, are associated with higher non-tenure-track faculty employment in these models.

Panels C and D of the table again introduce the possibility of lagged adjustment. Again, adjustment of tenured and tenure-track faculty to changes in equilibrium levels is faster than the adjustment of non-tenure-track faculty members. As in the first two panels of the table, non-tenure-track faculty members' employment levels are more sensitive to their average salaries than are tenure-track faculty members' employment levels to their average salaries. Again, non-tenure-track faculty members' employment levels are positively related to tenure-track faculty members' salaries.

3.4 NEW HIRE EQUATIONS

Each year the American Association of University Professors (AAUP) collects (but does not publish) information on the number of continuing full-time faculty members (by rank) employed at each academic institution that responds to the AAUP's annual salary survey.¹⁴ Continuing faculty members in a rank are defined as full-time faculty members who were employed at the university in the rank in the previous year and who are still employed at the university in the current year, regardless of their current ranks.

If one subtracts the number of continuing faculty members at an institution in a rank in a year from the number of faculty members in the rank in the previous year and sums the differences across ranks, one obtains an estimate of the number of full-time vacant faculty positions that potentially could have been filled by new faculty hires at the institution. That is, ignoring changes in the institution's desired faculty employment level caused by changes in enrollments, changes in revenues, or changes in average salaries of faculty members, this vacancy estimate tells us the number of full-time faculty new hires that are required in the year to keep full-time faculty employment at the institution constant.

While the AAUP data does not distinguish between ‘vacancies’ that are due to the departure of tenured and tenure-track faculty members and those that are due to the departure of non-tenure-track faculty members, it is possible to construct an estimate of each type of vacancy by assuming that the departures of all professorial ranked faculty members are departures of tenure and tenure-track faculty members and that the departures of all instructors are departures of non-tenure-track faculty members.¹⁵ Data on the new hires of full-time faculty members for each institution by tenure and tenure-track status, but not rank, are available every other year from 1989 in the Fall Staff Survey. As noted above, full-time faculty members are defined differently in this survey than they are in the AAUP Survey or the Faculty Salary Survey because visiting faculty members and faculty members without instructional responsibilities are included in the Fall Staff Survey.

With this proviso in mind, we use the new full-time faculty hire data from the Fall Staff Survey for 1989 to 1997 to estimate equations in which the number of newly hired faculty members at an institution, who are on tenure or tenure-tracks on the one hand and on non-tenure-tracks on the other hand, are each assumed to depend upon the number of tenure-track faculty vacancies at the institution over the period, the increase in revenue per full-time equivalent student received by the institution, the change in its full-time equivalent student body, the logarithm of the average salary of its tenured and tenure-track faculty, and the logarithm of the average salary of its non-tenure-track faculty, members. Models are estimated that both include and exclude year dichotomous variables.¹⁶

The estimated coefficients from these models appear in Table 3.6. Turning first to the results for new hires of tenured and tenure-track faculty members, the models that use either the number of professorial vacancies at the institution (panels A and B) or those that use the total number of faculty vacancies (including instructors) (panels C and D) perform very similarly. Only about 3 to 4 per cent of all vacancies for full-time faculty members in a year were filled by new hires of tenure and tenure-track faculty members during the year. Increased revenue per student leads to increased full-time tenured and tenure-track new hires, as do increases in the number of full-time equivalent students. However, these variables’ coefficients are not always statistically significantly different from zero and, at the margin, each increase of 100 full-time equivalent students leads to the hiring of only about 0.2 more full-time tenured and tenure-track faculty members. Higher average salaries for professorial faculty are associated with fewer tenured and tenure-track faculty new hires, but this relationship is statistical significant only in the models that exclude year effects.¹⁷

Table 3.6 Number of new hire faculty, institutional fixed effects
(*t* statistics in parentheses)

	New hire tenure and tenure-track faculty	New hire non-tenure- track faculty
(A) Without year effects		
Professorial vacancies	0.0440 (2.32)	
Instructor vacancies		-0.2814 (-2.6)
Revenue change per FTE in 1000	0.2322 (1.35)	0.4921 (2.06)
FTE change in 100	0.2126 (2.13)	0.0523 (0.38)
Log (ave. ten. and ten.-track fac. sal.)	-14.6044 (-2.75)	6.4247 (0.87)
Log (ave. non-tenure-track fac. sal.)	2.1517 (0.58)	-2.1235 (-0.41)
R^2	0.8436	0.8365
N	1868	1868
(B) With year effects		
Professorial vacancies	0.0403 (2.11)	
Instructor vacancies		-0.2923 (-2.7)
Revenue change per FTE in 1000	0.1901 (1.09)	0.5162 (2.14)
FTE change in 100	0.1744 (1.72)	0.0461 (0.33)
Log (ave. ten. and ten.-track fac. sal.)	-1.3842 (-0.14)	32.8974 (2.42)
Log (ave. non-tenure-track fac. sal.)	2.6754 (0.72)	-1.3754 (-0.27)
R^2	0.8443	0.8375
N	1868	1868
(C) Without year effects		
Total vacancies	0.0315 (1.8)	-0.0098 (-0.4)
Revenue change per FTE in 1000	0.2242 (1.3)	0.4744 (1.98)
FTE change in 100	0.2155 (2.16)	0.0722 (0.52)
Log (ave. ten. and ten.-track fac. sal.)	-14.4818 (-2.73)	7.8810 (1.07)
Log (ave. non-tenure-track fac. sal.)	2.2026 (0.6)	-2.0518 (-0.4)
R^2	0.8432	0.8354
N	1868	1868
(D) With year effects		
Total vacancies	0.0275 (1.57)	-0.0091 (-0.37)
Revenue change per FTE in 1000	0.1808 (1.04)	0.5025 (2.08)
FTE change in 100	0.1762 (1.73)	0.0712 (0.5)
Log (ave. ten. and ten.-track fac. sal.)	-1.3129 (-0.13)	32.5641 (2.39)
Log (ave. non-tenure-track fac. sal.)	2.7293 (0.74)	-1.3725 (-0.27)
R^2	0.8440	0.8363
N	1868	1868

Turning to the results for full-time non-tenure-track new hires, non-tenure-track new hires are negatively associated with the number of instructor vacancies at an institution and unrelated to the total number of full-time vacancies. The former result may reflect that 'vacancies' for instructors are often involuntary in nature, when the demand for them declines, academic institutions fail to reappoint faculty members in the role, which creates 'vacancies'. Other factors held constant, the greater the number of such vacancies the fewer the number of non-tenure-track faculty appointments. Increases in revenues per student are associated with increases in non-tenure-track new hires, but changes in full-time equivalent student employment are not. In the models that include year effects, increases in the average salaries of tenured and tenure-track faculty members are positively and statistically significantly associated with increases in the hiring of non-tenure-track faculty. Increases in the average salaries of non-tenure-track faculty are negatively associated with fewer full-time non-tenure-track faculty hires, however this latter relationship is never statistically significantly different from zero.

3.5 CONCLUDING REMARKS

Our chapter has presented evidence from a variety of sources that show that, during the decade of the 1990s, the usage of full-time non-tenure-track faculty and part-time faculty continued to grow at four-year colleges and universities in the United States. Lacking data on the salaries of part-time faculty, we could not estimate demand functions for them. However, models of the demand for full-time faculty and for full-time faculty new hires that we did estimate suggest, in the main, that as the salaries of full-time non-tenure-track faculty decline relative to the salaries of full-time tenure and tenure-track faculty, the relative usage of full-time non-tenure-track faculty will increase.

Between 1989 and 1997, the ratio of the average salary of lecturers to the average salary of all professorial faculty members at four-year colleges and universities in the United States declined from 0.642 to 0.607 in the Faculty Salary Survey data. This suggests that declining relative salaries of full-time non-tenure-track faculty members played a role in their increasing relative usage during the period.¹⁸ Four-year American colleges and universities have been able to attract lecturers at salaries that have been falling relative to their tenure-track colleagues' salaries because of the large number of PhDs available to fill such positions in many fields. However, this does not imply that lecturers and other full-time non-tenure-track faculty members are happy in their roles and the growing

salary gap between them and their tenured and tenure-track counterparts is undoubtedly one of the main forces leading to efforts by various unions to unionize full-time non-tenure-track faculty members.¹⁹ Hence, the relative cost advantage of full-time non-tenure-track faculty members may diminish in the future.

Of course parents of college-age students, taxpayers more generally, state legislators and governors, and the trustees of private colleges and universities may reasonably ask why they should be concerned about the growing use of part-time and full-time non-tenure-track faculty members. Surprisingly, very few studies have addressed whether the increased substitution of part-time and full-time non-tenure-track faculty for tenure-track faculty at higher education institutions leads to adverse academic outcomes for undergraduate students, such as less learning in any class, longer times to degree, lower graduation rates, or a lower proportion of graduates going on to post-graduate study. Analyses of these issues will be essential if public institutions want to make the case to their state legislators and governors, and private academic institutions want to make the case to their trustees, that better funding would enable them to increase their usage of tenure-track faculty members and that this would enhance undergraduate students' educational outcomes.²⁰ Our own preliminary research²¹ that uses institutional-level panel data provided by the College Board, suggests that when an institution increases the share of its full-time faculty that is non-tenure-track, or increases the share of its faculty that is employed part-time, it is associated with reductions in the six-year graduation rate of the institution's undergraduate students.

Finally, it is well known that the proportion of PhDs granted by US universities that go to US citizens has been falling over a long period of time. In some science and engineering fields, and in economics, the proportion of PhDs granted to US citizens is now well under 50 per cent (see, for example, Siegfried and Stock 2001). Universities and public policy-makers would do well to contemplate what the likely affect of their increased usage of part-time and full-time non-tenure-track faculty is on the desire of US college graduates to go on to PhD study. Put more starkly, by increasing their reliance on non-tenure-track faculty, American colleges and universities may be making PhD study a less attractive option than would otherwise be the case.

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NOTES

1. Ronald G. Ehrenberg and Daniel B. Klaff (2002) provide some preliminary evidence using data from the State University of New York (SUNY) system.
2. Both surveys are components of Integrated Postsecondary Education Data System (IPEDS), released by the National Center for Educational Statistics, accessed at www.nces.ed.gov/ipeds/.
3. The one exception is the Doctoral II category in which the public share is slightly higher than the private share.
4. Data for 2001 are currently not available for the Faculty Salary Survey.
5. The latter restriction is necessary because it is impossible to determine whether a blank represents zero or missing data in a year. As a result, the shares of full-time faculty members that are part-time may be overstated in these data.
6. The Fall Staff Survey also contains information on the usage of graduate teaching and research assistants. From 1989 to 2001, the usage of graduate assistants, relative to total full-time faculty, increased by about 20 per cent at both private and public research and doctoral universities.
7. Elastic demand curves are ones in which the percentage change in employment that occurs in response to a given percentage change in the average salary for the group is larger than the percentage change in salary.
8. We exclude instructors initially because nationally over 15 per cent of them at Research I and Research II institutions, and 25 to 30 per cent of them at other institutions, are tenured or on tenure-track lines.
9. The latter is computed as the total institutional revenue (including tuition and fees, appropriation, grants and contracts, sales and services, and other sources) minus the funding for Pell grants that the institution receives from the federal government.
10. Let $(F_T/E)^*$ be the equilibrium level of tenured and tenure-track faculty per student for an institution in year t that results from equation (3.2) in the text. The partial adjustment model specifies that $(F_T/E)_t - (F_T/E)_{t-1} = k((F_T/E)_t - (F_T/E)_{t-1})$, where k is the adjustment coefficient. If k equals one, then full adjustment occurs in one year. If k is less than one, adjustment to equilibrium is only partial in a year. This model leads to an equation similar to (3.2), save that the lagged value of tenured and tenure-track employment per student also appears on the right-hand side and this variable's coefficient is equal to one minus k . A similar equation is specified for non-tenure-track faculty.
11. For example, the coefficient of about 0.15 on the lagged value of lecturer employment implies that about 85 per cent of the adjustment to the new equilibrium level of lecturer's employment occurs within the one-year period.
12. We experimented with allowing more complex adjustment processes, such as including lagged values of both faculty employment levels in each faculty employment equation or allowing the speed of adjustment to equilibrium to depend upon the fraction of faculty with tenure or on tenure tracks. However, these extensions did not improve the fits of our models.
13. Appendix B provides details of how the average salaries of tenured and tenure-track faculty, on the one hand, and non-tenure-track faculty, on the other hand, are computed by us.
14. The AAUP salary survey builds on the IPEDs *Faculty Salary Survey* and faculty members are thus defined in the AAUP survey as faculty members with at least some instructional responsibility.

15. Sadly the AAUP began collecting continuing faculty data for lecturers only in 1996, so lecturers 'vacancies' must be excluded from these analyses.
16. Institutional dichotomous variables are included in these equations for the reason discussed in Appendix A.
17. As Appendix A makes clear, excluding year effects imposes the restriction that the ratio of the average salary of tenured and tenure-track faculty in a rank to the average salary of non-tenure-track faculty in a rank at an institution does not vary over time. So this is a very restrictive assumption.
18. As we have discussed above, not all lecturers are non-tenure-track, not all professorial faculty are on tenured or tenure-track lines and instructors (left out of the computation of the ratio) are employed on all three types of appointments. However, we cannot estimate more accurately how the average salary of full-time non-tenure-track faculty members has changed vis-à-vis the average salary of their tenured and tenure-track counterparts, because the method we used to compute relative salaries of the two groups to conduct the estimation that led to Table 3.5 required us to assume that in a given year the ratio of salaries of the two groups at an institution were constant across ranks, but varied across institutions. These ratios were treated as unobserved institutional dichotomous variables that were subsumed in the more general institutional dichotomous variables that are included in our model.
19. By way of an example, in May 2003 non-tenure-track faculty members at the University of Michigan voted to create a union to represent the 1300 full-time and part-time non-tenure-track faculty at the university (Smallwood, 2003).
20. One study of community college students that randomly assigned them to sections of a remedial mathematics course that were taught by part-time and tenure-track full-time faculty found no differences in the amounts that students learned (Bolje, 1995). Another study of a Midwestern comprehensive institution found, using four years of data on fall entering freshmen, that the greater the proportion of part-time faculty that students had during their first semester in college, the lower the probability that they would return for their second semester (Harrington and Schibik, 2001). Studies by economists have tended to focus on how instructor type (including graduate students) influences the amount that students learn in first-year classes (Finegan and Siegfried, 1998; Watts and Lynch, 1989) and the results vary across studies. Bettinger and Long (2004) use data from Ohio public four-year colleges to study the impact of adjunct faculty and graduate students (as compared to full-time faculty regardless of tenure or tenure-track status) on student enrollment and success in subsequent courses in a subject. They find that adjuncts and graduate students tend to reduce student interest in taking subsequent courses, but that the effects are small and vary across disciplines.
21. See Ehrenberg and Zhang (2004).

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APPENDIX A

Table 3A.1 Full-time non-tenure-track faculty/total full-time faculty

	1989	1991	1993	1995	1997	1999*	2001*
Public (sample size)							
Research I (53)	0.245	0.253	0.263	0.286	0.332	0.356	0.375
Research II (25)	0.183	0.171	0.179	0.192	0.233	0.244	0.274
Doctoral I (27)	0.160	0.193	0.191	0.202	0.213	0.235	0.237
Doctoral II (34)	0.176	0.176	0.200	0.206	0.212	0.226	0.240
Comprehensive I (229)	0.133	0.133	0.132	0.129	0.141	0.153	0.179
Comprehensive II (21)	0.181	0.141	0.132	0.119	0.146	0.182	0.199
Liberal arts I (4)	0.134	0.110	0.140	0.125	0.117	0.109	0.121
Liberal arts II (61)	0.213	0.211	0.187	0.202	0.195	0.223	0.242
Total	0.191	0.194	0.201	0.212	0.241	0.260	0.281
Private (sample size)							
Research I (26)	0.312	0.358	0.344	0.335	0.410	0.432	0.434
Research II (11)	0.173	0.165	0.186	0.180	0.196	0.222	0.230
Doctoral I (19)	0.233	0.193	0.231	0.212	0.234	0.256	0.274
Doctoral II (15)	0.132	0.122	0.153	0.137	0.144	0.159	0.191
Comprehensive I (164)	0.188	0.197	0.195	0.207	0.212	0.242	0.254
Comprehensive II (58)	0.207	0.199	0.216	0.227	0.220	0.239	0.230
Liberal arts I (149)	0.155	0.158	0.149	0.149	0.154	0.173	0.183
Liberal arts II (319)	0.287	0.294	0.297	0.292	0.286	0.321	0.328
Total	0.235	0.248	0.250	0.248	0.275	0.301	0.309

Note: *The numbers for 1999 and 2001 are from the preliminary data released by NCES

Source: National Center for Education Statistics, Fall Staff Survey (2004)

APPENDIX B

Let F_{ijt} be the number of faculty members of rank i at institution j in year t . Let f_{ijt} be the fraction of faculty members of rank i at institution j in year t that have tenured or tenure-track appointments. Finally, let S_{ijt} be the average salary of faculty members of rank i at institution j in year t . Then the number of faculty members at institution j with tenured or tenure-track appointments in year t is simply the sum over all ranks (i) of $F_{ijt}f_{ijt}$ and the number of faculty members on non-tenure-track appointments is simply the sum over all ranks (i) of $F_{ijt}(1 - f_{ijt})$. Each of these sums can be directly calculated from the *Faculty Salary Survey* data. Put another way, we know

from the data the number of tenured and tenure-track and the number of non-tenure-track faculty members at each institution in each year.

We know the average salary of faculty members of each rank at each institution in each year. We do not have information on the average salary of faculty members at each rank in each year by tenure-track status. However, an estimate of these numbers can be obtained if one is willing to assume that the average salary of tenured and tenure-track faculty at a rank is a constant multiple of the average salary of non-tenure-track faculty at the rank. This multiple is assumed to be constant across ranks at a given institution over time but is allowed to vary over time. That is, letting the subscript T represent tenured and tenure-track faculty and the subscript N non-tenure-track faculty, we assume

$$S_{ijtT} = m_{jt} S_{ijtN} \quad (\text{B.1})$$

and

$$m_{jt} = b_i d_t. \quad (\text{B.2})$$

It immediately follows that the average salary of tenure and tenure-track faculty members across all ranks at institution i at time t (S_{itT}) is given by the sum across all ranks of $S_{ijt} b_i d_t F_{ijt} f_{ijt}$ divided by total tenured and tenure-track faculty employment at the institution. The average salary of non-tenure-track faculty members at the institution is similarly calculated by replacing the f_{ijt} by $(1 - f_{ijt})$ in the expression above. All the variables in each of these two expressions are known numbers save for b_i and d_t which are treated as parameters that vary across institutions and over years. When one takes the logarithm of each average salary expression, as is done when we estimate logarithmic demand equations (Table 3.5) and new hire equations (Table 3.6), the logarithm of each average salary is equal to the sum of the logarithm of a known number and the logarithms of an institutional and a year effect. Hence the b_i and d_t are subsumed in the institutional and time fixed effects.